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WHAT IS CLAIMED IS:

1. (Amended) A light source device having a light source element from which output light is emitted to outside via a multiple scattering optical system, wherein

the multiple scattering optical system includes at least a first region that is located adjacent to the light source element, and a second region that abuts on the first region and reaches the outside,

of the first and second regions, at least the first region contains scatterers, and a density of the scatterers in the first region is higher than a density of scatterers in the second region, and

the light source device has an amount of near-field pattern speckles σ_{PAR} that is within a range of:

$\sigma_{PAR} \geq 3 \times 10^{-3}$.

2. The light source device as claimed in claim 1, wherein

the device comprises a recess portion having a wall surface and a bottom surface that define the first region, wherein a metal layer is formed on at least part of the wall surface and/or of the bottom surface, and the light source element is directly or indirectly fixed to the bottom surface, and

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a surface of the metal layer formed on the at least part of the wall surface and/or of the bottom surface of the recess portion serves as a reflective surface to scattered light of the output light from the light source element.

3. The light source device as claimed in claim 2, wherein

the metal layer on the at least part of the wall surface and/or of the bottom surface of the recess portion is continuously formed so that substances other than the metal are not exposed in a principal portion positioned within reach of the scattered light spatially distributed in the first region.

4. (Amended) The light source device as claimed in claim 2, wherein

a surface of a metal layer formed on at least part of a wall surface of a recess portion serves as a reflective surface that changes an optical axis direction of an outgoing beam of the light source element toward an interface between the first and second regions, and

assuming that a size parameter q, which represents a relation between a particle size mode Ds of the scatterers and a center wavelength λ in a base material

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of the first region of the light source element, is expressed by:

$$q = (2\pi/\lambda)\cdot(Ds/2),$$

then the size parameter q of the first region falls within a range of approximately 1 to 15.

5. (Amended) The light source device as claimed in claim 2, wherein

the surface of the metal layer formed on at least part of the wall surface of the recess portion serves as a reflective surface that changes an optical axis direction of an outgoing beam of the light source element a plurality of times, and

assuming that a size parameter q, which represents a relation between a particle size mode Ds of the scatterers and a center wavelength λ in a base material of the first region of the light source element, is expressed by:

$$q = (2\pi/\lambda)\cdot(Ds/2),$$

then the size parameter q of the first region falls within a range of approximately 10 to 50.

6. The light source device as claimed in claim 5, wherein

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an opening of the recess portion has a diameter larger than that of the bottom surface, and

assuming that a ratio of a depth to the diameter of the bottom surface of the recess portion is given as an aspect ratio, r, and an angle made between a normal line of the wall surface of the recess portion and the optical axis of the outgoing beam of the light source element is θ [deg], then a condition expressed by:

$$\max\{2r, 3\} \leq \theta \leq 20r$$

is satisfied.

7. The light source device as claimed in claim 5, wherein

at least part of the wall surface of the recess portion forms a cylinder whose top and bottom have approximately same sectional configurations, and

assuming that a ratio of a depth to a diameter of the cylinder of the recess portion is given as an aspect ratio, r, and an angle made between a normal line of the wall surface of the recess portion and the optical axis of the outgoing beam of the light source element is θ [deg], then a condition expressed by:

$$\max\{\operatorname{atan}(r/5), 3\} \leq \theta \leq \operatorname{atan}(r/2)$$

is satisfied.

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8. The light source device as claimed in claim 1, wherein

the second region has a lens portion.

9. The light source device as claimed in claim 8, wherein

the lens portion serves as a magnifier for at least a principal portion of a secondary planar light source formed at an interface between the first region and the second region.

10. The light source device as claimed in claim 1, wherein,

assuming that a size parameter q, which represents a relation between a particle size mode Ds of the scatterers and a center wavelength λ in a base material of the first region of the light source element, is expressed by:

$$q = (2\pi/\lambda)\cdot(Ds/2),$$

then the particle size mode Ds of the scatterers is within a range that allows the size parameter q to fall within a range of approximately 1 - 50, and at least the first region includes a portion where the scatterers are dispersed at a high density so that an average nearest neighbor distance of the scatterers becomes equal to or

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smaller than twenty times the particle size mode Ds of the scatterers.

11. The light source device as claimed in claim 1, wherein

the first region employs a gel-like or rubber-like material as the base material.

12. The light source device as claimed in claim 1, wherein

the light source element is a semiconductor laser.

13. The light source device as claimed in claim 12, wherein

the semiconductor laser has an active layer including an InGaAs layer on a GaAs substrate and an emission wavelength within a range of from 880 nm to 920 nm inclusive.

14. The light source device as claimed in claim 13, wherein

the semiconductor laser has the active layer including the InGaAs layer on the GaAs substrate and includes at least one of a ternary layer or a quaternary

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layer which are expressed by $In_XGa_{1-X}As_YP_{1-Y}$ ($0 \leq X < 1$, $0 < Y < 1$).

15. The light source device as claimed in claim 12, wherein

the semiconductor laser has spatial fluctuations in at least one of its composition or its layer thickness.

16. (Amended) The light source device as claimed in claim 15, wherein

the semiconductor laser has the active layer including the InGaAs layer on the GaAs substrate and includes at least one of a ternary layer or a quaternary layer expressed by $In_XGa_{1-X}As_YP_{1-Y}$ ($0 \leq X < 1$, $0 < Y < 1$) which has spatial fluctuations in its composition.

17. (Amended) The light source device as claimed in claim 1, wherein

at least part of a wire connected directly or indirectly to the light source element exists inside the second region.

18. An optical communication module employing the light source device claimed in claim 1 as a transmission means..

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19. The light source device as claimed in claim 1, wherein

assuming that a transport mean free path of the scatterers is l_{AVE} and a dimension in the optical axis direction of the first region is L, then a transport optical depth L/l_{AVE} is approximately 1 to 100.

20. (Added) The light source device as claimed in claim 1, wherein

the amount of near-field pattern speckles σ_{PAR} is within a range expressed by:

$\sigma_{PAR} \leq 3 \times 10^{-1}$.

21. (Added) The light source device as claimed in claim 1, wherein

the light source element has an optical waveguide structure.